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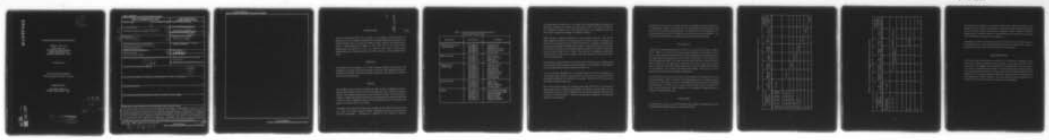

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EXTENDED TRIPLINE SENSOR TOOLING

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31 MARCH 1977

FINAL TECHNICAL REPORT
FOR CONTRACT DAAA21-76-C-0502

PREPARED FOR

PICATINNY ARSENAL
DOVER, NEW JERSEY 07801

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20. ABSTRACT (CONTINUE ON REVERSE SIDE IF NECESSARY AND IDENTIFY BY BLOCK NUMBER)

The intent of the contract to provide handline tooling capable of assembling a minimum of 4000 extended tripline sensors per month was achieved. No tooling or test equipment was provided to perform the required non-release test of 4,000 g's along the direction of deployment. Honeywell Design Engineering concluded that the extended tripline sensor will not withstand a force of 4,000 g's along the deployment axis. Deviations XM75-171 and XM74-009, which called for the elimination of the requirement, were submitted and approved. Advantage was taken of existing production facilities, which were included as part of the handline process. The automated production line for the ADAM tripline sensor is being utilized to obtain the release mechanism and case assembly.

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INTRODUCTION

Contract DAAA21-76-C-0502 was awarded to the Defense Systems Division of Honeywell Inc. for the design and fabrication of handline tooling for production of the extended tripline sensor in quantities of 4000 per month minimum. This final technical report is being submitted in response to Data Item 003 of the Contract Data Requirements List (DD Form 1473). The contents of this report will provide an understanding of the tooling provided for handline assembly of the extended tripline sensor.

OBJECTIVE

The objective of the program was to utilize existing standards, specifications, and drawings for materials, parts, and practices to the extent that engineering initiative would not be thwarted. In addition, handline tooling was to be fabricated at minimum cost per such documentation.

RESULTS

The tooling procured during this program (see Table 1) has the capability of 4000 to 5000 extended tripline sensors per month assuming that fully trained personnel are utilized. The extended tripline sensor is very intricate in design. This has resulted in relatively complex tooling whose functions must be understood by production personnel in order to achieve satisfactory results. The training period varies with personnel, but appears to be in the order of 4 to 8 weeks.

The bobbin winder (28112272-T1) has some variability at the present time which results in a yield of 22 percent defective bobbin assemblies--16 percent reworkable and 6 percent nonworkable. Elimination or reduction of the 16 percent defective

Table 1. Tooling Procured for Handline assembly of The Extended Tripline Sensor

Subassembly	Tool Number	Tool Name
Release Mechanism and Case Assembly	28112280-T1	Compound nest
	28112280-T2	Ball dispenser
	28112280-T3	Staking ram and nest
	28112280-T4	Vacuum ram and nest
	28112280-T7	Ram and nest
Bobbin Assembly	28112272-T1	Bobbin winder
	28112276-T1	Tape cure fixture
	28112276-T2	Bobbin nest
	28112276-T4	Tape dispenser
Sensor Case and Bobbin Case	28112266-T1	Assembly fixture
	28112266-T4	Tube extractor
	28112280-T2	Ball dispenser
	28112270-T5	Spring selector
	28112270-T2	Rough drill fixture
	28112270-T3	Final drill fixture
	28112266-T5	Wiring fixture
	28112270-T6	Vacuum pickup
Sensor Assembly	28112266-T2	Hand tool
	28112270-T4	Solder station
	28112266-T3	Potting dispenser
	28112270-T7	Vacuum pickup
Gaging	28112270-G1	Force displacement gage
	28112282-G1	Functional location gage
	28112271-G1	Special ring gage
	28112271-G2	Spring test nest
	28112284-G1	Special ring gage
	28112266-E2	Deployment fixture

reworkable bobbin assemblies can be accomplished by reprogramming the winding cycle along with redesign of the bobbin nest which does not have fixed stops for location. This redesign and rework has not been undertaken due to the production delay that would result and additional slippage of production schedules.

Bobbin winding is being accomplished on a semi-automatic machine. This machine neither applies the tape dot to secure the thread nor cures the tape. The original plan, therefore, was to apply and cure the tape off the machine. Attempts to accomplish this proved fruitless because the thread had a tendency to loosen and unwind on the bobbin. To overcome this problem, a manually operated tape dispenser is utilized to apply tape (as well as tape curing) on the winder. This results in a completely wound bobbin directly off the winder, but unfortunately means that the tape cure fixture (28112276-T1) is not being utilized.

No tooling was fabricated under this contract which could be utilized to assemble any portion of the release mechanism and case assembly. This assembly is being obtained from the ADAM tripline sensor automated production line.

The tube extractor (28112266-T4) is not being utilized. This tool is comparable to a two-jaw gear puller without a driving screw. Its function was to remove the anchor guide after completing the assembly of the springs. However, the anchor guide was removable without the gear puller.

Due to the electrode design, the soldering station (28112270-T4) is not providing the proper type of heat to the joint being soldered. This problem is being worked on under the production contract with the equipment manufacturer's applications personnel, and a solution is expected shortly. Sensors are being soldered manually, and production delays are not anticipated.

Installation of the end cap is a complex operation in that eight tabs must be folded over to complete the assembly. The design of a tool was generated to partially bend these tabs in order to hold the assembly together. It was found to be more expedient to do the entire operation manually. Tooling which would form these tabs completely is not economically feasible when considering the low volume in handline assembly.

TEST RESULTS

Verification of proper tooling function is borne out in the test results shown in Tables 2 and 3. Table 2 is a summary of test results upon deployment of the initial set of 50 sensors. Major problems encountered were thread entanglement and tape dot failures. The bobbin winder was adjusted for nest location and tensioning. This eliminated the thread entaglement problem. The tape dot failure was eliminated in the second test (as shown in Table 3) by the application of Eastman 910 to the locking turns of thread around the spindle. The bobbin winder program has since been modified by the addition of one additional turn of thread around the bobbin spindle. This results in a lower pulling force on the tape and acceptable holding power.

Thread failures shown were the type where thread separated when pulled with a force less than 540 grams. This is a function of the actual thread and is not related to tooling or processs. This thread is common to the ADAM tripline sensor, where a comparable condition exists. Corrective action to prevent these failures would of necessity be a joint venture between the thread supplier and the appropriate design personnel at Picatinny Arsenal and Honeywell.

CONCLUSIONS

The intent of the contract to provide handline tooling capable of assembling a minimum of 4000 extended tripline sensors per month was achieved.

Table 2. Tool Certification Analysis (Summary Sheet) - First Test

Extended Tripline Sensor Serial Number	OK 100 Percent	Tape Dot Failure	Thread Failure	No Release	Thread Tangle	Post Pull	No Continuity	Retention Continuity Until Thread Break
1, 4, 6, 7, 8, 12, 15, 17, 18, 21, 22, 28, 31, 33, 39, 40, 42, 43, 46, 47, 48, 50	22 Total							
9, 14, 19, 20, 23, 24, 26, 30, 37, 44, 45, 51, 10, 35, 41		15 Total						
13, 25, 29, 34, 3			5 Total					
36, 38, 5				3 Total				
16, 27, 32					3 Total			
2						1 Total		
11							1 Total	
49								1 Total

Table 3. Tool Certification Analysis (Summary Sheet) - Second Test

Extended Tripline Sensor Serial Number	OK 100 Percent	Tape Dot Failure	Thread Failure	No Release	Thread Tangle	Post Pull	No Continuity	Retention Continuity Until Thread Break
All except as indicated below	44 Total							
7, 25, 28, 29			4 Total	Serial Number 25 disregarded because of erratic slow pull				
				0				
					0			
20						1 Total		
							0	
33								1 Total

No tooling or test equipment was provided to perform the required non-release test at 4000 g's along the direction of deployment. Honeywell Design Engineering concluded that the extended tripline sensor will not withstand a force of 4000 g's along the deployment axis. Deviations XM75-171 and XM74-009, which called for the elimination of the requirement, were submitted and approved.

Advantage was taken of existing production facilities, which were included as part of the handline process. The automated production line for the ADAM tripline sensor is being utilized to obtain the release mechanism and case assembly.

RECOMMENDATIONS

Two sensors being so nearly alike are different in an area where next assembly requirements create excessive handling in sensor assembly. Specifically, this refers to the notch that must be applied to the diaphragm of the extended tripline where this notch is not required on the ADAM tripline sensor. This notching operation cannot be added to the automated assembly machine. Therefore, parts must be manually removed from the magazines of the automated assembly machines for notching and then reloaded into the same magazine for further assembly. This extra operation could be eliminated by a revision to the mine where interference results from the diaphragm.